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Editor

ELEMENTARY PRINCIPLES AND PRACTICES IN SANITATION OF WATER AND SEWAGE

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The diseases involved in the field of sanitation of water supply and disposal of sewage and excreta are simply the communicable diseases of the human alimentary tract. Very few diseases of animals are transmissible to man, or vice versa. For all practical purposes, these human diseases include only typhoid fever, paratyphoid fever, cholera, amoebic dysentery and bacillary dysentery, all of which are the result of live pathogenic organisms. Simple diarrhoea may be caused by bacterial invasion and by products of spoilage or decay. It is not usually a serious disease.

In the case of water, it may be that excessive amounts of decaying substances also explain some of the diarrhoea outbreaks that seem to follow the lines of travel of the particular water. It is well known that certain minerals in water act on an irritant principle, the same as do the cathartics. Sulphates (SO_4) are the basis of epsom salts or Glauber's salts. If present in 500 or more parts per million of the water, consumers may experience a laxative effect. Still other minerals, if in excessive quantities, will exert a cathartic action on the bowels. Usually persons soon become accustomed to mineralized waters, as they do to cathartics. On the desert, people regularly use waters that others could not tolerate.

The infected excreta which cause communicable diseases of the bowels can only originate in persons harboring the respective diseases. Sewage and excreta from well persons can not transmit these diseases. Persons ill from these diseases may be actually ill, or they may be known as "carriers," that is, persons who have suffered mild or more or less severe cases of the disease and have apparently recovered. They are ambulatory or walking cases. Their feces still contain the pathogenic organisms for a gradually diminishing period after seeming recovery. Convalescents commonly remain "carriers" for months and sometimes for years. That is why mixed sewage of a large population is dangerous all the time and why sewage of small groups may cause no disease. It also follows that in time of an outbreak of an intestinal disease the sewage is to be regarded as highly dangerous.

When the pathogenic organisms enter the mouth of a well person, a new case or cycle of the disease is established. Any avenues or article by which particles of the excreta or sewage of the ill person or the carrier can be transmitted to the mouths of well persons can result in spread of the disease. Common modes of spread are:

(1) Fingers, direct to the mouth, or via foods, milk, water, etc., handled by infected hands;
(2) Flies or other insects or even animals carrying infection to foods, milk, etc.;
(3) Water, polluted by the excreta or sewage and thence direct to mouth of well persons, or by way of foods, milk, vegetables, oysters, etc.

Sanitation of water and sewage simply attempts to break the chain of transmission or travel of these diseases from the source to well persons. This is done in various ways. Either they are preventive of infection, e.g., good sewage disposal; or else corrective, as is water treatment. Though water may be an important vehicle for the transmitting of infected excreta or sewage to well persons, it is not the only means of

spread and, in fact, in many parts of the United States in recent years, water has become a less important factor than many others. Certain characteristics of outbreaks help to throw light on the vehicle of infection. So does knowledge of the interval between infection and onset of the disease, as it often enables one to trace back to some article of food or contact peculiar to the date of infection.

Interval Between Infection and Onset of the Disease

Disease	*Range of interval in days*	*Ordinary interval*
Amoebic dysentery	2 days to months	3 to 4 weeks
Bacillary dysentery	1 to 7 days	1 to 7 days
Cholera	1 to 5 days	3 days
Paratyphoid fever	4 to 10 days	7 days
Typhoid fever	3 to 38 days	7 to 14 days

In case the disease follows only routes of distribution of the water, food or milk, etc., then that article is at once suspected and should be investigated. Water and milk-borne epidemics are generally explosive and sudden, and they follow the lines of distribution of the water or the milk route. On the other hand, sporadic, isolated cases, or cases localized to the consumers of certain articles of food or drink point to that article as the vehicle of infection. It is upon such facts that the epidemiological investigation proceeds.

Fresh sewage of a large population is likely to contain not only typhoid, because the odds favor it, but also dysentery organisms because they remain alive only a short time. Typhoid organisms remain alive in sewage for many days and in water for weeks. In foreign countries, cholera is also to be reckoned with.

Water or milk contaminated by fresh sewage may, therefore, first result in a dysentery outbreak within a day or two, followed by the more serious disease of typhoid fever some time later. A dysentery outbreak should therefore be the signal to check on the water supply. On the other hand, sewage which is not of recent origin is not likely to contain live dysentery organisms, though it may cause typhoid fever or, in foreign countries, cholera. Amoebic dysentery is dangerous because of the eggs or "cysts." These do not remain in suspension in water as readily as do bacteria. The disease is more apt to be carried by foods and hands, and especially by uncooked foods.

Infection of milk may result in wholesale cases of disease, or in sporadic cases, all depending on how the milk became infected. Thus in a milk bottling plant, only those bottles in which the machine capper failed and which were capped by the hands of a typhoid carrier, became infected and caused casual and widely-scattered cases of typhoid; however, the cases were limited to the milk route in question. Oyster-borne typhoid fever, like that from other infected foods, will be found to be limited to consumers of the particular article, and this often enables the investigator to establish the means of spread of the infection.

Use of Chemicals. Use of chemicals to combat excreta-borne disease dates back into the last century when cholera and typhoid fever were rampant in England and in many parts of Europe. Use of chemicals is still indicated to this day, under many conditions. One of the most useful is hydrated lime or quicklime because of its caustic action. It is not difficult to use lime and it is one of the commonest of chemicals. When reasonably fresh it exerts a certain caustic effect and it may be safely and unstintingly spread over areas polluted by sewage or excreta, thus neutralizing and destroying the pathogenic organisms. Similar in action is soda ash or lye.

Fresh chloride of lime, chlorine solution, and phenolic or carbolic compounds exert powerful disinfecting action and ought to be kept on hand. The active ingredient of chloride of lime and chlorine solutions is chlorine. These compounds should be used while fresh, and if stored should be kept from the air and from the light. To disinfect the excreta produced by one person in a day requires a minimum of approximately one-half ounce of active chlorine. This is equivalent to two ounces of reasonably fresh chloride of lime containing 25 per cent active chlorine; or 2.5 ounces of 20 per cent chlorine solution. Because of possible weakening of strength and inefficient application, one should double or treble these amounts when scattering these chemicals over areas or deposits to be rendered innocuous. Any of these substances, if used to afford ample cover and admixture with sewage matter, are valuable measures in control of diseases of sewage.

Dehydration or drying out of excreta or sewage matter destroys many, if not all, of these organisms and is a natural protective influence. A measure that goes back to antiquity is burial of dangerous substances. Covering of the sewage or excreta with a deep body of earth can speedily stop transmission of disease to others. Cooking and boiling of foods and water is likewise a powerful and adequate natural protection. That is why tea is a safe water to drink. One needs to employ high heat and not mere warming.

Excreta Disposal. Any method of excreta disposal that lessens the means by which particles of it may be transmitted to others helps to control the disease. Such measures include burial, use of dry pit latrines and chemical toilets. The burial idea may be applied with the use of some container or bucket whose contents are buried and wholly covered up. Dry pit latrines or "privies" depend on the same idea. They need to be constructed with a fairly deep pit which is so braced that it does not cave in and so expose the con-

tents. Flies, insects, and even animals must always be excluded from the excreta. If the pits are kept dark, flies naturally stay away. Excreta pits which encounter water make for a wet mixture and an increased odor, as well as for wider percolation of infected excreta through the ground. To reduce odors and health hazards, sprinkling of lime, caustic, ashes, earth or phenol within the pit is important. Kerosene may also be beneficial. Excreta held in pits soon ages and loses its powers of spreading disease. But the contents should not be used for fertilizing vegetables for human food or be spread near wells or springs. Before the pit fills up, the privy should be moved and the hole covered over with a couple of feet of packed earth. It is not necessary to add chemicals, though there is no harm in it.

Chemical toilets are simply a combination of a seat and riser, like a toilet, with a watertight drum or container beneath in which a solution of caustic soda is maintained to destroy the excreta. Nearly always these are proprietary devices. As soon as the soda ash has been consumed, more caustic must be added. Ultimately, the container must be emptied and the contents buried.

Waterflushed Systems. As soon as water becomes available, then wet methods of sewage disposal are possible and desirable. The simplest, though far from satisfactory, is the trough latrine. It is simply a trough above which there are toilet seats. Every half hour or so the excreta caught in the trough is flushed out of it. This flushing may be done manually, but it is more satisfactory to do it by some automatic flushing or tipping device. If the trough is flushed constantly, a great deal of sewage is produced which it may not be possible to handle in a sanitary manner.

Kitchen slops, lavatory water, bath water and even laundry water are simply dirty. As a vehicle of spreading disease they are negligible. If sewage disposal is difficult, it sometimes helps to segregate these wastes and dispose of them separately by spreading on top of the ground, while making a sanitary underground disposal of the toilet and urinal drainage.

If sewage disposal is difficult and water is expensive, it is important to keep plumbing fixtures in the best of condition to avoid leakage or unnecessary water consumption.

Sewers to carry toilet drainage in the house and from the house need to be laid on a grade of not less than $\frac{1}{8}$ inch and preferably $\frac{1}{4}$ inch per foot.

The means of disposing of waterflushed sewage usually depends on the quantity. Where the amount is small, e.g., from 100 to 200 people, an underground method of leaching is generally feasible and all efforts should be bent to make it a success. With larger flows of sewage, say from 500 people or more, disposal methods above ground are necessary for economy, even though the operating chores are tedious. These methods are more complicated and can not well be covered in this article. The simplest of these is irrigation, preceded by some treatment to remove solids that choke the soil. For populations in between, each case needs to be analyzed on its own merits.

Sewage Disposal for Small Groups. The elements of this disposal system must be kept simple. They usually include:

(1) A septic tank to settle out the solids which otherwise clog the soil;

(2) An underground leaching system, which may be either a leaching cesspool which is not much more than a hole in the ground, or

(3) A covered ditch in which the liquid may seep away. In either case, for sanitary reasons the cesspool or sewage ditch positively needs to be enclosed or covered. For short periods of use the septic tank may be omitted and both operations of settling and leaching carried on in the cesspool itself.

Septic tanks or cesspools should not be located under or too near the house, nor in yards where children play. To leave space for the rest of the system the tank should be located as high up on the plot as the buildings permit and located where soil conditions are absorptive.

Septic tanks are nothing more than box-like settling tanks adapted to sewage. In the course of digestion, the excreta and other solids in them reduces in volume on an average of 50 per cent. Also scum forms many inches thick, which it is necessary to hold back. They need to be designed to hold the undigested portion or sludge which is roughly 20 gal. per capita per year; and, in addition, space or size should allow for settling the liquid sewage for at least 24 hours. Flow of sewage per capita to be settled would run, say, 10 or 12 gal. per capita per day for toilet flushing only, and upwards of 35 gal. if all drainage enters the tank. The figure may run to 60 gal. if precautions to reduce use of the water are not good. Assuming a yearly cleaning of a septic tank under ordinary conditions, one would allow a capacity up to the water line of 60 to 75 gal. per capita. For a longer period of use between cleanings, allow from 100 to 125 gal. per capita. Design features of a septic tank are that it should be two or three times as long as it is wide, and a little deeper than it is wide; also that the sewage would enter at one end and be taken off at the other by an outlet that submerges a few inches to escape scum effects. Also, it is very helpful to divide the tank into two compartments, the first being about twice as large as the second. Compart-

ments are formed simply by a partition wall across the tank extending from the bottom almost to the top, with portholes at about mid-depth to allow passage of the water only from one compartment to the other. Septic tanks are usually airtight but this is only to confine the odors.

To decide dimensions, first settle on the number of people to be served and probable flow of sewage per day. Let us assume 100 persons and 40 gal. of sewage per capita. Required volume is 100 x 40 gal. = 4,000 gal., plus an allowance for sludge. Assume a cleaning every three years. Therefore, allow 60 gal. per capita or 6,000 gal. more for sludge. Total is 10,000 gal. Reduce to cubic feet by dividing by 7.5; hence, 1,333 cubic feet is the capacity needed in our example. Next, decide the depth to use below the water line, say 4 ft. Plan area is therefore 1,333 + 4 ft. = 333 sq. ft. Since the length should be about three times the width, it will soon be found by trial that the plan size is roughly 10 ft. wide by 33 ft. long. Depth is 4 ft. plus an extra ceiling or freeboard to the roof for scum, of say 10 or 12 inches. In emergency cases, septic tank action can be gotten by building a long narrow earthen basin, provided with a submerged outlet to avoid fouling the effluent with scum. Raw sewage can also be cleared of its coarse solids in another way by causing it to flow out on land in a sheet-like fashion, and this method too should be remembered for emergency conditions. Neither of these methods is really sanitary for long use. It is not necessary to seed a septic tank. Simply proceed to use it.

The heart of the sanitary result by this foolproof system is not the septic tank but the underground leaching. The tank merely protects the soil against choking. The leaching system should be located in deep, porous soil, preferably in ground that is not waterlogged. The simplest leaching system is the cesspool. It is usually a rather deep hole, and for that reason it is more likely to pollute underground drinking water strata than is the case with the shallow leaching ditch which most sanitarians prefer.

To figure the extent or area of either system is a matter of deciding the percolation power of the soil in question. Soils differ in their capacity for percolation. Thus, real coarse sands may percolate or leach, say, 5 gal. of sewage per day, day after day, whereas tight soils may leach only 0.5 gal. The common soil formation, which is loose loam, is usually good for one to two gal. per square foot per day.

Thus, assuming the sewage produced is 40 gal. per capita per day and the soil is capable of absorbing one gal. per square foot, then 40 sq. ft. of exposed cesspool, or 40 sq. ft. of leaching ditch system exposed to percolation action, are necessary per person. If the leaching ditch is 18 inches wide and may be wetted 6 inches deep, the exposed area per foot of length is 2.5 sq. ft. Hence, the leaching ditch in this case would be 16 ft. long per person. Since such calculations made in advance are at best crude estimates, any system laid out should allow for expansion if experience shows it to be necessary.

The leaching ditch system is essentially a ditch 2 to 3 ft. deep and 1.5 ft. or more wide, which it is imperative be laid on a very flat grade, sloping not over $\frac{1}{2}$ inch in 10 feet. If laid steeper than this, the sewage will run rapidly to the lower end and spurt out on the ground. After the ditch is dug the bottom should be loosened by a pick or shovel. From this point on there are two methods of procedure. One is to lay on the bottom of the ditch what amounts to a trough upside down. The sewage finds its way out the bottom as it flows along the length of the trough. The trough is finally backfilled over with earth as a cover.

A more common method is to backfill the ditch, after first loosening the bottom, with several inches to a foot of even-sized coarse rock to act as a sewage strainer; then on this lay a distributor channel. This may be either a tile pipe with open joints one-half or three-fourths inch apart; or it may be a small upside down V-shaped trough with notched ports in the sides of the V to let the sewage out into the rock. In either case the distributor used should rest on a broad board support for good grade and distribution.

The next operation is to cover the tile or the V trough with something that will keep earth from sifting into the rock beneath. Grass, burlap sack, tarpaper, etc., will do this. Then backfill with enough earth to confine the smells. Six inches is a suitable cover. Maximum length of a single run of filter ditch is approximately 200 ft. If more length than this is needed, make a layout that will provide additional lines or runs. These may be parallel 6 to 10 feet apart or even run in some other direction, as in a herringbone fashion. Since expansion of these lines may be necessary later, lay out the system on high ground rather than low ground so that expansion is easily possible.

The leaching cesspool, as has been mentioned, is simply a hole in the ground. It is well to line it with a loose rock wall, preferably circular, or with timber cribbing. It is also helpful to backfill behind the wall with very course material to improve leaching. A good substantial cover should be used.

For Large Groups of People. The methods here described will be limited to those which are especially adaptable to distinctly rural conditions where isolation

is good. If methods used by cities and towns are required, then special engineering advice is urged.

It is always necessary as a first step in sewage disposal to settle the sewage and remove the solids which otherwise clog the system beyond. For sewage flows of from, say, 500 to 1,000 population there is little choice in the methods of sewage settlers. The septic tank is the simplest, but it has the drawback of producing the most offensive smelling, rotten effluent. If the water supply of the place is high in sulphur, such effluents will be extremely evil smelling. If the sulphates in the water are low, the smells in septic sewage are not unbearable.

Design of septic tank follows the same general basis as that given for smaller groups, except that the depth of tank may run to 6 or 8 feet regardless of the width. The same two compartment design is recommended and it is important to make the tank two or three times as long as it is wide; also to bring sewage in at one end and to take it out the opposite end through a submerged outlet.

An alternate method of settling sewage which is an improvement over the septic tank is by the use of a two-story Imhoff Tank. This, however, is quite an engineering design and if sewage studies are anticipated one should obtain expert engineering advice. In an Imhoff Tank the sewage is settled in the upper compartment and the sewage digests in the lower.

Disposal of effluent in either case must be adapted to the soil and countryside and to other conditions. Where the equivalent of farming or irrigation can be employed, this is a cheap, effective method of disposal. These sewage effluents are still putrescible and dangerous. Therefore, they can not be handled as promiscuously as is irrigation water. If possible, the sewage should be piped or flumed to the disposal plot, which should be blocked off in checks, or furrows, or basins into which the sewage can be run each day in rotation. As the ground dries out, it may need to be recultivated before reuse.

As a rule, soils should be dosed not more than one day in seven to keep them from going sour. Hence, if the sewage flow should wet one acre in one day, then altogether at least seven acres should be allowed for sewage disposal purposes.

The amount of land required obviously depends on its porosity. The heavier soils will take only 3,000 to 5,000 gallons of sewage per day, allowing for the rest periods. Loose granular soils will take perhaps 20,000 to 30,000 gallons per day allowing for rest periods.

Having decided on the acreage, then the rest of the planning is simply one of laying out header ditches or pipelines, and gate arrangements to let the sewage onto the checks, or furrows, or basins, depending on what is used.

Where soils are extremely tight and large acreages may be required, it is sometimes possible to make use of the effects on sewage of causing it to stand in the air, to so modify it that it becomes innocuous. In places where there is a great deal of sunlight, such as in California and the southwest portion of the United States, sewage is quite readily "conditioned" in so-called sewage ponds or lagoons. The action in these lagoons is at least three-fold. First, air gets to the sewage; second, the microscopic plants in them produce oxygen which consumes the organic matter; and third, microscopic animal life in the lagoons consumes the bacteria. To accomplish these purposes the size of lagoons must be ample to prevent septic, i.e., stagnant conditions. Calculations need to be made to test out the proposed layout.

First, there ought to be enough holding capacity in the lagoons to consume the organic matter. Roughly speaking, the volume required is 75 to 150 cubic feet of water space per person served. The second calculation is the holding time to permit disappearance of sewage organisms. For this purpose, assuming little or no loss by percolation, the holding time required is approximately 20 days, and in less sunny climates, even more. Thus, assuming 40 gal. of sewage per day, the cubic feet of water space is 800 gal., or slightly over 100 cubic feet per person. The larger of the two calculations should prevail.

The third calculation is the percolation rate. If the soil absorbs the water too rapidly, a lagoon may not even form. Then to make this method satisfactory greater depths of water must be employed. Depths of water of less than 18 inches are seldom satisfactory on account of weed growth. Assuming a depth of 2 ft. possible to attain, and 100 cubic feet per capita required, the area needed per capita is 50 sq. ft. We have assumed the sewage flow was 40 gal. per day. Therefore, the percolation rate would be 0.8 gallon per square foot per day. However, if the percolation capacity of the particular soil exceeds 0.8 gallon per square foot, it means that the sewage would soak away so fast that it would be a long time before a lagoon would form. The depth would in that case have to be increased, or the idea abandoned.

In laying out the lagoons the acreage decided upon should be divided into three or four basins. Any larger number is unnecessary and is even a drawback. The sewage will enter the first basin, then overflow to the second, thence to the third and to final disposal, wherever it may be. The first lagoon will probably accumulate putrid solids in the course of a year or so

and the layout should permit throwing this unit out of service, decanting off the water, and cleaning the sludge deposits out as soon as they become dry.

Water Supply. Sanitation of water supplies means developing and handling the water so that human sewage will not pollute the water, or else destroying the pollution. Hence, the source of the water should be located in a place where it is not subject to drainage of human sewage or excreta. Wells 75 feet or more from sewage are reasonably safe. While there is a certain amount of self-purification of running water, or in standing pools of water, to evaluate the safety in a given case requires an expert. The layman would do well not to use creek or river water unless he knows for sure that there is no human drainage into it. Unless he knows this to be a fact, he should not take a chance. If he must take a chance, then he should employ reliable treatment of the water to destroy any danger.

Springs. As a rule, it is better to develop springs or wells in a clean, safe location than to use stream water. Developing of springs is simply a matter of tapping the vein of water and boxing it in or covering it to exclude animals and dangerous drainage, after which the water is simply piped to the distribution tank or to the system as the case may be. For well supplies one should be careful to locate them uphill from any dangerous drainage or keep them at a safe distance.

Dug Wells. Dug wells are least desirable because they are most subject to the percolation of dangerous soil pollution into the water strata. If a dug well must be used, by all means locate it out of the path and uphill from pollution. Also, it is of great value to case the well clear down to the water level so that nothing can enter the well without penetrating through considerable depth of soil. Pollution of soil, of course, tends to be filtered out with depth. As a rule, nothing less than 15 to 30 feet downward filtration or 75 feet or more or horizontal filtration will adequately take out the dangerous organisms. Therefore, the depth of casings or the walls of the well should be governed accordingly. Dug wells should be curbed above the ground so that no dirty water can overtop them, and they should have a good watertight cover.

Cased Wells. The safest development of wells is the cased well, which is either very deep, say, 100 or 200 feet deep, or if shallow, is bored through a natural clay blanket which thus separates the polluted surface water from the subterranean water. Well casings should be watertight to the levels at which the water will be taken and the casings should be carried above ground so as to be higher than the highest flood waters in the vicinity. As a rule, screw-joint pipe like water pipe is very reliable. Such wells are usually bored by auger or by a churn drill.

There is a type of well known as well-point construction which also uses water pipe, but it is constructed by use of a perforated well point which is kept under pressure while the hole is being driven. In the course of use, the ground water enters the well through these same perforations. They are always at the bottom of the well. Hence, if such wells set below the depth of surface pollution they are quite safe.

Pumping equipment for wells may be most any type. But, whatever the type, it is well to carry any waste water, or pump drainage far off to the side so that it does not waterlog the immediate vicinity of the well, and avoid pollution by the hands.

Tanks and Reservoirs. The important thing about tanks and reservoirs for storing water is mostly one of covering them for the sake of keeping the water clean. Otherwise, waters standing in the open exposed to sunlight develop a microscopic plant life known as moss or algae, which compares to the grass and the weeds that grow in the fields. Covering these containers shuts out the light and stops the growth, thus keeping the water naturally sweet and clean. It is well to locate the take-off pipe in a tank or reservoir a few inches to a foot or so from the floor so as to escape sludge or settlings.

Cisterns for storing roof or rain water are seldom used nowadays. If used, they need to be constructed and protected the same as other tanks. Roof water, of course, though not dangerous, is more or less dirty. Such water is very soft, but it may not be palatable as it undergoes stages of decomposition.

In handling water on the premises, so far as health is concerned, the important thing is to handle it in such a way that polluted hands do not recontaminate the water with disease germs. Thus, barrels or containers from which water is dipped are very likely to be fouled by the hands of carriers of disease. It is always important to provide faucets to avoid this hand pollution. To avoid still other diseases such as are spread from mouth to mouth, the common drinking cup is an abomination. Each person should have his own private drinking cup or individual drinking containers. Where possible, paper cups should be provided.

Water Treatment. Up to this point, it is assumed that the water will not require treatment. In the event there is a hazard to health or a doubt about the water, then some form of water treatment should be employed. One fairly simple method is to utilize the disinfecting powers of chlorine to destroy pathogenic organisms. This is feasible in the case of typhoid fever, dysentery, and cholera, but it is not so effective in the case of water containing the cysts of amoeba. To destroy the

first mentioned diseases, chlorine must be used in sufficient amount to combine with the organic matter and then leave a surplus which will destroy the bacteria. For ordinary waters which are not colored or high in moss or algae, the ordinary amount of chlorine in the form of solutions whose strength is approximately 5 per cent active chlorine is as follows:

DISINFECTION OF CLEAR WATER OF LOW ORGANIC MATTER CONTENT USING APPROXIMATELY 5 PER CENT CHLORINE SOLUTION

Gallons of water to be treated	*Quantity of chlorine solution (Household chlorine disinfectant) (Sodium hypochlorite)*
1	2 drops
2	3 drops
5	8 drops
10	16 drops
50	1 standard teaspoonful
100	2 standard teaspoonfuls
500	3 standard tablespoonfuls
1000	6 standard tablespoonfuls

Another rule is to use enough disinfectant so that a noticeable chlorinous taste persists in the water half an hour or so after the disinfectant has been added, and thoroughly mixed with the water. For colored or organic waters, one would double or treble the above doses.

The method of use of these solutions depends on the particular system. Where tanks are employed, a quite satisfactory method is to provide two tanks instead of one, each one large enough to hold at least one or two days' supply of water. Then each time the idle tank is filled with water, mix into it the required amount of chlorine solution and let this tank stand until the other tank has run nearly empty and it is necessary to switch over to the treated tank.

If the solution must be fed to the stream of water as it fills the tank, the job is more complicated and it is difficult to give directions in this article.

Another method of treating small amounts of water is known as super-chlorination. This method is especially suited to waters that are highly polluted or subject to leaf stain or moss. By this method the amount of chlorine used may be five or ten times that given in the table. The result will be a decidedly chlorinous taste. After the solution has been mixed with the water and it has stood for an hour or more, the excess chlorine is then destroyed or neutralized by the use of photographic "fixer" or hypo, also known as sodium thiosulphate. The amount of this to be used may have to be determined by experiment to just kill the taste.

Some waters contain chemicals which are decidedly obnoxious. One of the most common of these is iron. It exhibits itself by iron rust or curd in the water and is found chiefly in spring or shallow well water which comes from formations containing decomposing leaf material. This forms an acid which dissolves the iron out of the soil and it reprecipitates on standing, as an iron curd. Iron is entirely harmless to health, but it stains badly and makes tea or coffee very black. It is sometimes feasible to remove it by aerating the water and then letting it stand so that the iron curd settles to the bottom. The top water is much improved and may become usable.

There is no simple laboratory control of the purity of water supplies. From the point of view of health the test most useful is that for sewage organisms, but even this test requires laboratory knowledge. The test is not a positive one inasmuch as it does not distinguish between animal manure and human excerta. The organisms determined by this test are those of any of the warm-blooded animals. Combined with the knowledge of field conditions, however, this laboratory test is a useful one.

This article at best simply traces the reasoning behind the things sanitarians do to break the chain of transmission of the more serious of the communicable diseases of the human digestive tract, and incidentally to make for cleaner living. Enough examples may have been given that by the use of common sense in the field other ways of attaining the objectives may be achieved.

UNIVERSITY HONORS SAM H. GREENE

On the twenty-fifth anniversary of the organization of the California Dairy Council at a meeting in San Jose, Dean C. B. Hutchison of the College of Agriculture, University of California, presented a token of appreciation to Sam H. Greene, Secretary of the Council, which reads as follows:

"The University of California to
SAMUEL HARTLEY GREENE

"Son of Maine, the barometer of political storms, descendant of generations of professional men and sturdy New England seafaring folk, successively railway clerk and stenographer, farm laborer, tobacco salesman, dairy manufacturer, public servant, pioneer in California in improving the quality of dairy products, first advocate and user of attractive and sanitary cartons in the marketing of butter, earnest, wise, and vigorous proponent of the welfare of the dairy industry through science and education, leader in programs designed to acquaint the public with the role played by dairy products in the nutrition and health of the people, stimulator of effective cooperation between the dairy industry and public health and educational agencies in establishing good food habits in the youth of the land, creator and builder, and, for a quarter of a century, the guiding hand of the California Dairy Council: A monument to your genius for vision and leadership.

"In recognition of your services to State and Nation, the University of California presents to you this token of its appreciation and affection.

Berkeley, February 16, 1944

ROBERT G. SPROUL
President of the University

C. B. HUTCHISON
Dean of the College of Agriculture"

In presenting the scroll, Dean Hutchison said, "This is the anniversary of the birth of an idea that has been tested in the crucible of time for a quarter of a century. It is as outstanding an example as one could find where the welfare of an industry has paralleled that of the people. The College of Agriculture has been proud to be associated with the California Dairy Council and to have aided in the promotion of its work."

Health officers throughout California will approve of this appreciation of the activities of Sam Greene in the production of pure milk and in the education of the general public relative to the nutritional values in this essential product. His efforts in the production of pure milk throughout California are outstanding and it is a pleasure to give recognition to the results achieved by this diligent worker in a field that is of tremendous importance in the maintenance of health in the people of California.

HEALTH IN "YOUR TOWN"

The Oakland City Health Department, in cooperation with the Junior Chamber of Commerce, is sponsoring a series of five radio broadcasts entitled HEALTH IN "YOUR TOWN," broadcast each Friday, 4.15–4.30, during March over Station KLX. The series dramatize what the health department does. Members of the Junior Chamber of Commerce are the actors.

Following are the subjects for the five broadcasts:

March 3—What the Health Officer Does
March 10—What the Public Health Nurse Does
March 17—What is Being Done in "Your Town" About Tuberculosis
March 24—What is Being Done in "Your Town" About Venereal Diseases
March 31—What is Being Done in "Your Town" for Future Citizens

Scripts of the series will be mimeographed and available to health officers. Author of the scripts is Mrs. Helen Morgan Hall, City Health Department Health Educator.

MORBIDITY REPORT—FEBRUARY, 1944

Reportable diseases	Week ending				Total cases	5-yr. median	Total cases
	2-5	2-12	2-19	2-26	Feb.	Feb.	Jan.-Feb., inc.
Amebiasis (Amoebic Dysentery)	5	------	1	------	6	------	13
Anthrax	------	------	------	------	------	------	------
Botulism	------	------	2	------	2	------	5
Chancroid	8	8	13	10	39	------	71
Chickenpox (Varicella)	737	1,099	992	1,045	3,873	3,673	7,413
Cholera, Asiatic	------	------	------	------	------	------	------
Coccidioidal granuloma	------	------	------	------	------	------	2
Conjunctivitis—acute infectious of the newborn (Ophthalmia Neonatorum)	------	------	------	------	------	------	3
Dengue	------	------	------	------	------	------	------
Diphtheria	35	34	31	17	117	96	245
Dysentery, bacillary	2	5	9	4	20	------	51
Encephalitis, infectious	1	1	2	------	4	------	8
Epidemic diarrhea of the newborn	1	------	------	------	1	------	1
Epilepsy	31	35	20	17	103	------	198
Food poisoning	------	2	8	10	20	------	126
German measles (Rubella)	294	298	387	309	1,288	------	1,874
Glanders	------	------	------	------	------	------	------
Gonococcus infection	298	268	268	412	1,246	1,134	2,606
Granuloma inguinale	------	------	------	2	2	------	4
Influenza, epidemic	429	217	124	195	965	403	10,007
Jaundice, infectious	5	7	5	10	27	------	47
Leprosy	------	------	------	------	------	------	------
Lymphogranuloma venereum (lymphopathia venereum, lymphogranuloma inguinale)	6	4	7	10	27	------	55
Malaria	6	------	4	1	11	2	16
Measles (Rubeola)	548	620	807	867	2,842	1,741	4,132
Meningitis, meningococcic	31	31	32	29	123	8	261
Mumps (Parotitis)	619	561	807	793	2,780	1,656	5,557
Paratyphoid fever, A and B	------	------	------	------	------	------	1
Plague	------	------	------	------	------	------	------
Pneumonia, infectious	132	138	105	61	436	386	1,121
Poliomyelitis, acute anterior	7	2	11	5	25	11	46
Psittacosis	------	------	------	------	------	------	------
Rabies, human	------	------	------	------	------	------	------
Rabies, animal	17	15	15	16	63	39	124
Relapsing fever	------	------	------	------	------	------	------
Rheumatic fever	10	9	7	11	37	------	63
Rocky Mountain spotted fever	------	------	------	------	------	------	------
Scarlet fever	285	284	234	294	1,097	678	1,984
Septic sore throat, epidemic	------	------	------	------	------	------	------
Smallpox (variola)	2	1	------	3	6	0	14
Syphilis	501	558	419	661	2,139	1,717	4,212
Tetanus	1	1	------	------	2	------	3
Trachoma	14	3	1	1	19	------	35
Trichinosis	------	2	1	------	3	------	9
Tuberculosis, pulmonary	157	180	158	151	646	550	1,198
Tuberculosis, other forms	10	12	7	5	34	29	73
Tularemia	------	------	------	------	------	------	1
Typhoid fever	5	1	2	6	14	11	21
Typhus fever	------	------	------	------	------	------	1
Undulant fever (Brucellosis)	2	4	3	1	10	14	29
Whooping cough (Pertussis)	83	76	80	75	314	1,179	585
Yellow fever	------	------	------	------	------	------	------
					18,341		42,215

No one could ever meet death for his country without the hope of immortality.—Cicero.

American business, free labor and free agriculture have built within these two years a far greater war machine than Hitler's dictatorship built in ten years. Every day we grow stronger and we can now see ultimate victory. It may be a long, hard, costly struggle, but we are going to win.—Frank Gannett.

The world has been steadily getting better, and I say this while a war is going on. Nothing happens that is not for the best. One of the eternal truths of this world is that there is always change and that this change is progress. And changes occur so quickly that nobody but a fool would dare to predict what will happen. But I do know that the changes I have seen are only stepping-stones for what is going to happen.—Henry Ford.

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